



DOCTOR CARLOS JUAN FINLAY



UNITED STATES YELLOW FEVER COMMISSION AT HAVANA,
CUBA, IN 1879.

Left to right: Standing, A. Moréjon, R. Matas, G. M. Sternberg, T. Guiteras; Seated, T. Hardee, H. C. Hall (U. S. Consul-General), S. E. Chaillé, D. M. Burgess (Sanitary and Quarantine Inspector at Havana of National Board of Health).

CARLOS FINLAY'S CONTRIBUTION TO THE EPIDEMIOLOGY OF YELLOW FEVER*

C. C. DAUER AND G. M. CARRERA

The contributions of Dr. Carlos Finlay to the study of the epidemiology of yellow fever have never been given the attention they deserve. One cannot escape the conviction that his theory of the propagation of the disease was correct in nearly every respect twenty years before Walter Reed and his associates definitely proved that the mosquito was the transmitting agent.

Finlay not only pointed out the mosquito as the transmitter but he also pointed out a "culex" mosquito as the species. This mosquito, now designated *Aedes aegypti*, was selected by Finlay because of its town-dwelling habits. He failed in one respect in that he did not recognize that there was an extrinsic incubation period of about twelve days in the mosquito. Carter, of the United States Public Health Service, about 1898 suggested the possibility that such an incubation period in an insect intermediate host might be required. Although there is no proof that Finlay's volunteers became infected by means of his mosquito experiments or that intercurrent infections in this endemic area were precluded, he laid down the principles which later led to definite proof of *Aedes* transmission of yellow fever. After enunciating his theory of the mosquito transmission of the disease, Finlay continued to gather evidence to prove his ideas.

Finlay was not the first to propose the idea of insect transmission of yellow fever. In 1848, Dr. Josiah C. Nott of Mobile, Alabama, made the suggestion that the specific cause of the disease might be found to exist in some form of insect life. Contrary to the frequently expressed opinion, Nott did not suggest the mosquito transmission of yellow fever but that the disintegrating bodies of mosquitoes in water when drunk caused yellow fever. In 1853, Dr. Louis Daniel Beaupérthuy, a native of Guadeloupe and a physician with a very strong biological trend, stated very definitely that he regarded the mosquito as the source of the disease in man. How-

* From the Department of Preventive Medicine, School of Medicine, The Tulane University of Louisiana.

ever, he believed that the mosquito obtained its infectious material from soil or decomposed matter. About the same time (1852), Surgeon-General Daniel Blair in British Guiana stated that the

EL MOSQUITO

HIPOTETICAMENTE CONSIDERADO COMO AGENTE DE TRANSMISION

DE LA

FIEBRE AMARILLA.

POR EL

DR. CARLOS FINLAY.

Miembro de número de la Real Academia de Ciencias, de la Sociedad de Estudios Clínicos de la Habana y de la "Société Scientifique de Bruxelles."



HABANA

IMPRENTA LA ANTILLA, DE M. CACHO NEGRETTE.
CALLE DE CUBA NUMERO 51.

1881.

spread of yellow fever suggested "to the imagination the attributes of insect life."

In 1879 the National Board of Health in Washington appointed a commission to investigate the cause of yellow fever. This group,* in cooperation with an auxiliary Spanish commission, spent several months in Cuba investigating the disease. As a member of the Spanish commission and representative of the Havana Academy of Science, Finlay expressed the opinion that the excessive alkalinity of the air was in some unknown manner responsible for the disease. Dr. Rudolph Matas, who accompanied the American commission to Cuba, is our authority for the statement that Finlay had not at that

time expressed any opinions regarding the mosquito in relation to yellow fever. This statement is borne out by the fact that the extensive report of the commission only mentioned Finlay's views on

* Dr. Stanford E. Chaillé, New Orleans, Chairman; Dr. George M. Sternberg, U. S. Army, Secretary; Dr. John Guiteras, Philadelphia, and Thomas Hardee (civil engineer), New Orleans, members; Henry Mancel, New Orleans, photographer; Rudolph Matas, clerk; Dr. Abraham Moréjon, Cuba, interpreter; Richard Cay, Cuba, translator.

the alkalinity of the air. The investigations of the commission, it is needless to say, failed to disclose either the cause of the disease or its mode of transmission.

On August 14, 1881, Finlay read a paper before the Academy of Science in Havana on the subject of "The mosquito hypothetically considered as an agent in the transmission of yellow fever poison," the title-page of which is reproduced here and the translation reprinted. In this paper he expressed for the first time his views on the theory that the mosquito was the transmitting agent of the disease. During the twenty years which followed he contributed a number of papers on this same subject, most of which were in Spanish, but several also appeared in American and English medical journals. A complete bibliography of his works will be found in a recent biographical sketch of Finlay by Francisco Dominguez.

It is interesting to recall that Sir Patrick Manson made known his discovery in 1877 of the mosquito as the intermediate host of the parasite, *Filaria sanguinis hominis*, now designated as *Wuchereria bancrofti*. However, there is no record that Finlay knew of Manson's discovery, nor is there any reference to Finlay's theories in Manson's later writings.

Following Theobald Smith's splendid report in 1892 on the cause of tick fever in cattle, Finlay appears to have become more firmly convinced that the mosquito was the transmitter of yellow fever. Robert Koch's assertions in 1898 in favor of the mosquito as "one which most plausibly accounts for the propagation" of malaria also seems to have impressed him.

Finlay's original contribution, published in 1881, is referred to frequently in medical literature although its contents are not generally known. The translation into English in abstract form appeared in the *New Orleans Medical and Surgical Journal* for February, 1882. This translation was indexed in this journal by its title but not by its author or translator and it does not appear in *Index Medicus*, and for this reason, probably, was lost sight of later. The translator was a young medical graduate who had accompanied the American commission to Cuba—Dr. Rudolph Matas, now a surgeon of world-wide fame and the only person still living who went to Cuba with the yellow fever commission of 1879.

Like many other important contributions in the field of epidemiology, Finlay's work was given little consideration by his contemporaries. Finlay should be given credit for first suggesting and put-

ting to experimental test the possibility of mosquito transmission of yellow fever and for enunciating the theory that a specific type of mosquito was the transmitting agent of the disease. Reed and his associates should be given credit for definitely proving the mosquito transmission following an incubation period within this insect, and Gorgas for his practical applications of this knowledge in the control of yellow fever.

We are very grateful to Dr. Rudolph Matas for his valuable suggestions in preparing this introduction and for his permission to use his translation of Finlay's original paper. We also wish to acknowledge our indebtedness to Col. C. F. Craig and Professor E. C. Faust for their criticisms in the preparation of this material, and to Dr. Clyde Brooks for permission to use the photograph of Carlos Finlay.

REFERENCES

- Annual Report National Board of Health, Washington, 1879, 1880.
Boyce, Sir Rupert W.: *Mosquito or Man*. London, 1910.
Dominguez, Francisco: *Docteur Carlos J. Finlay*. Paris, 1935.
Finlay, Charles F.: Mosquitoes considered as transmitters of yellow fever and malaria. *Med. Record*, 1899, 21, 737-39.
Nott, J. C.: Yellow fever contrasted with bilious fever. *New Orleans Med. & Surg. J.*, 1848, 4, 563-601.